An Escape Game on University student mental health during the Covid-19 pandemic: a co-creation approach

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Abstract

Background: The Covid-19 pandemic has had a severe impact on students' mental health. Interventions are still needed to promote their psychological wellbeing and prevent mental illnesses during this unprecedented situation. Escape Games can be an effective tool to support students' mental health based on pedagogical innovation. A co-creation approach can improve their acceptability by involving different stakeholders (ex. end-users, game designers, health professionals) in order to obtain games which are adapted to the target audience.

Objective: This study aims to describe the process of testing and optimizing the game EscapeCovid on student mental health focusing on the needs of players in terms of form and contents.

Methods: The PRODUCES framework was used. Co-creation steps were explained for replicability. These included test of a first pilot version of the game by 45 students answering a satisfaction questionnaire, 10 semi-structured interviews with testers, meetings of stakeholders and brainwriting.

Results: Main findings of this study showed that students enjoyed playing the game EscapeCovid. This reflects general young people's appreciation for serious games using an entertaining approach for experiential learning. While playing, students were attracted by the scenario and delivered messages, feeling motivated to follow the story. Testers considered the game EscapeCovid as a tool helping learn new health-related topics. Playing in groups was also a strategy to make connections and combat isolation, particularly experienced during Covid-19

Conclusions: Our results suggest that co-creation contributes to improve the acceptability of a health promotion and disease prevention intervention and that an end-user-centered approach can facilitate the intervention tailoring. When conceiving a health-related Escape Game, we recommend to use the co-creation approach to increase players' appreciation and interest in the intervention, thus influencing eventually their learning process.

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ABSTRACT

The Covid-19 pandemic has had a severe impact on students' mental health. Interventions are still needed to promote their psychological wellbeing and prevent mental illnesses during this unprecedented situation. Escape Games can be an effective tool to support students' mental health based on pedagogical innovation. A co-creation approach can improve their acceptability by involving different stakeholders (ex. end-users, game designers, health professionals) in order to obtain games which are adapted to the target audience. This study describes the process of testing and optimizing the game EscapeCovid on student mental health focusing on the needs of players in terms of form and contents. The PRODUCES framework was used. Co-creation steps are explained for replicability. These include test of a first pilot version of the game by 45 students answering a satisfaction questionnaire, 10 semi-structured interviews with testers, meetings of stakeholders and brainwriting. The final version of the game was completely reshaped to meet end-users' expectations.

INTRODUCTION

University students can experience serious mental health problems during their studies, since they are exposed to several stressors including academic pressure, taking on more adult-like responsibilities or limited economic resources[1].

The Covid-19 pandemic has exacerbated students' mental health troubles which have skyrocketed during the repeated lockdowns between 2020 and 2021[2]. A general decline in terms of students' wellbeing was observed[3]. Shift to online courses, uncertainty about academic and professional future, and dramatic reduction of social interactions have largely contributed to impair the mental health of this population[4]. Restrictive measures were particularly associated to high levels of depression, anxiety and stress in students [5–7]. A systematic review of international studies reported that students' levels of moderate or severe depression, stress and anxiety climbed to 50.3%, 71% and 80%, respectively[8]. During the year 2020, nearly one-fifth of students experienced suicidal ideation, feeling overwhelmed but unable to get help as a result of Covid-19[9]. There was also an increase in loneliness from pre-pandemic to pandemic situation[10]. The prevalence of these mental health problems was more than 50% higher for students than in the general population during this time[11]. Student mental distress due to the Covid-19 pandemic still endures today[12].

Against this background, there has been a huge need for mental health prevention programs to tackle students' mental health problems during and after the lockdowns[13]. Several studies have described the development and application of interventions aimed at supporting students during the sanitary crisis. In particular, digital psychological interventions have produced positive effects on students by promoting resilience and positive wellbeing[14]. During the lockdowns, when face-to-face contact was limited, digital interventions had the advantage to reach a larger audience with no time or space limit. Examples of interventions were videoclips, online booklets, mobile applications, virtual doctor visits, etc. University students were particularly engaged by interventions delivered via the Internet since they are "digital natives" who generally prefer to seek self-help information online[15].

In order to optimize interventions, gamification is considered as imperative, even in the mental health field[16]. Gamification relies on the full involvement of the player while exploiting several psychosocial determinants (e.g. surrounding environment, social support)[17]. The step-by-step sequencing, rewarding system and solving of the puzzles stimulate the learning loop and solicits the cognitive capacity of the participants, like better knowledge of the subject of the game [18]. Games

engage players in retaining information in a more attractive and acceptable way, especially for a young target population[19].

Escape Games are a type of digital interventions based on gamification where players collaborate to find clues, complete tasks, and solve puzzles with the aim to achieve a specific, time-bound goal, which is usually to escape from the room. Previous research corroborates the constructive impact of Escape Games in improving health-related knowledge in players[20,21] by using a learning-by-doing approach [21].

Escape Games can contribute to deliver health-related messages by fostering motivation for behavioral change through a funny and playful approach according to the PRIME (Plan, Response, Impulses, Motives, Evaluation) theory of motivation[22]. Following this theory, a decision to do something will not result in action unless it generates the desire and the impulse to do it at the relevant moment. Thus, the stimuli of the game (actions, lights, sounds, colors) trigger feelings, ideas and brain activities for positive decision-making.

Co-creating and testing an Escape Game can foster its adoption[23]. An acceptable intervention includes the end-users in the process of its development. Indeed, when referring to a game, players' experience and needs are relevant for enhancing its performance. Other stakeholders (designers, health professionals, researchers) also contribute to produce and optimize a health-related gamified intervention by increasing its acceptability.

The objective of this study was to describe the process of co-creation of the Escape Game "EscapeCovid" about University students' mental health literacy, beliefs about mental health, management of emotions and positive coping strategies during the Covid-19 pandemic. Applied methodology is presented with the aim to be used as an example for producing an acceptable gamified mental health intervention addressed to young people.

MATERIALS AND METHODS

The first pilot version of "EscapeCovid": the Escape Game "Manage your Emotions"

"EscapeCovid" was based on an existing Escape Game which was used as the skeleton of the final game. "Manage your Emotions" was created in 2020 during the pandemic by a French start-up specialized in producing Escape Rooms, both real-world and online. Creators were game designers, programmers and healthcare professionals aged less than 35 years.

The game is set in the room of Tony, a University student living in a flat-share and experiencing the difficulties of the first lockdown. The game session involves four students/players and a game guide. The role of the game guide is to coordinate the whole game, to give clues if the players are stuck and to animate the debriefing session. The game session lasts in total two hours: 45 minutes of play and 1 hour and 15 minutes of debriefing. During the debriefing, the game guide and the players discuss in more detail the concept of emotions, i.e. how to identify and manage them. At the end of the game, players answer different questions one by one (without the game guide seeing their answers), allowing time for discussion between players after each question. During the game session, players follow Tony all along one ordinary day through three rooms of his apartment (office, living room and bedroom) and discover his emotions and their consequences on his daily life. Figure 1 illustrates Tony's office with some clues for the players.

<Insert Figure 1 about here>

Players solve puzzles by clicking on the elements of the screen each in turn and obtain emotion cards. The definition of the different emotions is based on the Plutchik's wheel of emotions [24] (Figure 2) which is the theoretical framework of the game.

<Insert Figure 2 about here>

According to the Plutchik's wheel of emotions, there exist 8 primary emotions: joy, trust, fear surprise, sadness, anticipation, anger and disgust. They can be combined in more complex secondary emotions, like joy and trust equal to love. In the wheel, darker colors correspond to more intense emotions. All combinations and intensities are explained in the cards. This theory by the psychologist Plutchik supposes that the more we know about emotions, the better we understand how various emotions are interlinked and how they can change over time. The Plutchik's wheel of emotions has been used in several studies as a scientific instrument to interpret emotions[25,26]. In this Escape Game, cards had to be associated to identify the emotions.

Test and optimization: co-creating "EscapeCovid"

"Manage your Emotions" did not fully cover mental health elements (mental health literacy, positive beliefs about mental health, management of emotions, positive coping strategies), being limited to management of emotions only. Furthermore, it presented several bugs and the scenarios did not reflect the real-life conditions of a student during the pandemic.

The co-creation process followed the PRODUCES framework [23]. For PRoblem, we wished to address students' mental health during the Covid-19 pandemic; for Objective, we aimed at developing the "EscapeCovid" game; for Design, we used a participatory methodology approach; the end-Users were University students; Evaluation was performed through questionnaires and semi-structured interviews; and for Scalability, the objective was to disseminate the new game to a larger extent.

In practice, co-creation was implemented in two steps: test and optimization. In the first step, the Escape Game "Manage your Emotions" was tested by a sample of students, two game guides (public health) and a developer (informatics). Game guides trained with colleagues and friends to annotate their first impressions on the game flow. Then, the official test phase was lunched: healthcare students played the game in groups of three or four supervised by a game guide. At the end of the game session, players were asked to answer an online questionnaire to rate their experience and providing inputs for improvement. Semi-structured interviews were conducted with some of them to obtain more in-depth advice for improving the game. In the second step, the game was optimized using the data from the test phase and the collaboration of one project manager (public health), one intern (cognitive engineering), one designer (game conceptualization), one developer (informatics), one medical doctor (public mental health) and one researcher (psychology). Meetings were organized to reshape the pilot game and brainwriting was used to collect ideas and pass them along to other stakeholders. The brainwriting technique consists in the written generation of ideas by different individuals on separate sheets which are secondly collated by the project manager in the same file. Ideas are categorized and synthetized in a shared document where collaborators can discuss them with written comments and paragraphs. Then, the team meets in person to find a solution which is acceptable to all stakeholders. This process can be done in an iterative loop[27].

The stakeholders involved in the study

A total of 45 healthcare students at the University of Bordeaux (France) participated to the test phase. We opted for healthcare students for assessing the relevance of the contents given their expertise in medical and paramedical care. Furthermore, previous studies show that healthcare students are a population at risk of mental illness [28]. They were recruited through snowball sampling starting from interns of the research center where the study was based and student associations. Through an email, students were directed to a form to schedule the game session. All 45 players received a 20€ gift

card. Among the 45 players, ten volunteered for participating also to a semi-structured interview and received a supplementary 20€ gift card.

According to the French law for health-related research (*Délibération n° 2018-155 du 3 mai 2018*), since the project consisted in providing satisfaction data with no repercussions on participants' health, no ethical approval was needed. Nonetheless, participants responding to the questionnaire were asked to electronically sign a consent form stating that their answers were completely anonymous without tracing. Interviewed students also signed a form assuring that the recording of the interview would be canceled after data analysis.

Data collection instruments and analysis

We applied a mixed-methods approach by using both questionnaires and semi-structured interviews. The satisfaction questionnaire was sent by email to students one day after having played the game. It included 12 items on the appreciation and relevance of the intervention. On a visual analogic scale from 0 to 10, students had to rate the fun of the game, its content, easiness, graphics, clarity of the objective and relevance. Students were also asked to state to whom they would advise the game; if they would pay for playing; if they had understood the importance of talking about mental health; if the game increased knowledge about mental health; if the game helped speak more freely about mental health; and if the game destigmatized mental health. Participants were also asked to give a final overall note to the game, from 1 to 5 stars. Sociodemographic characteristics were collected: gender, age and year of study. Variables were described as counts and percentages.

Semi-structured interviews were based on a grid composed of three macro-themes and related sub-themes: general description (student's presentation, previous experience with Escape Games, reason for participating to this study); testimony of the game session of "Manage your Emotions" (satisfaction, design and scenario, feasibility, acquired knowledge, advice to improve the game); and impact of the game (mental health learning, stigmatization, understanding and managing emotions, help-seeking, techniques for mental health promotion). Interviews were registered, fully transcribed and analysed through qualitative coding.

RESULTS

Socio-demographic characteristics

The quantitative sample of 45 students was purposely limited for a small-scale test. Among them, 34

were female students, 10 male and 1 non-binary. The mean age was 22 years old, minimum age 18 years old and maximum age 27 years old. The years of study extended from the first year of study until doctorate, the majority of the students attending the fourth year (n=16). The qualitative sample was composed of 7 female students and 3 male students.

Participants' gaming experience

Both samples of students responding to the questionnaire and to the semi-structured interviews reported enjoying the game session. For B, female student, 1st year of PhD in public health, the game experience was fine because *"We discuss between us, why and how it is this emotion and not another [..] it was really good"*. D, male student, 4th year of pharmacy, said: *"But yeah, I really liked the associations of emotions [...] frankly, we spoke with people we didn't know, so frankly it went well, it was cool"*.

The majority of the sample (66.7%) gave a positive score between 8 to 10 concerning the fun of the game. For 75.5% it was interesting (score from 8 to 10). Twenty-one students considered that the game was easy. The most frequent global note of the game was 4 out of 5 (55.6%).

Indeed, 46.7% of respondents to the questionnaire gave a positive score between 8 and 10 regarding the appeal of graphics. Concerning visual staging of the game, one student declared that the scenario was not coherent: *"Tony has a too big apartment for being a student"* (MA, female student, 2nd year of speech therapy). The storyline with Tony's character was also discussed. Some students questioned their identification: *"When Tony was talking, I didn't really get into the thing, in the end I found it very tricky, too tricky, a bit like a fake student"* (L, female student, 3rd year of speech therapy).

Regarding the overall content of the game, 60.1% of the participants found the objective of the game clear (score from 8 to 10) and 66.7% considered the content of the game suitable for students (score from 8 to 10).

Half of the sample (53.3%) would recommend the game to their close ones, especially their friends attending University (95.6%). However, the large majority of students (80.0%) would not pay for playing.

The knowledge acquired during the online game session

Among people from the quantitative sample, 60.0% said that the game made them understand the importance of talking about mental health and 84.4% thought that the game was likely to increase their knowledge about mental health. However, interviewed students reported that knowledge about mental health was addressed in an insufficient way.

Understanding and identifying the different emotions were fully covered, but the global concept of mental health was missing: "*it was really more about identifying emotions, and self-reflection*" (L, female student, 4th year of speech therapy); "*There would be a panel of important information to transmit on mental health"* (A, female student, 4th year of international health).

The development of the "EscapeCovid" game

Quantitative and qualitative data from the test phase informed the optimization of the game "Manage your Emotions" so as to obtain the new game "EscapeCovid". Data were collated and analysed by the stakeholders working on the development of the game. All results were considered for reshaping the new Escape Room accordingly. Results of the team meetings and brainwriting were also considered.

Table 1 reports the modifications made from the first version of the game to the final one.

Table 1. Comparison of features from the two version of the game

	Version 1 "Manage your Emotions"	**Version 2 "EscapeCovid"**
Objectives	Teach players to know, identify and manage their emotions.	Increase students' knowledge of mental health through emotions and symptoms of depression, anxiety, stress.
Game flow	45-minute game session (3 rooms: office, living room, bedroom) + 45-minute debrief.	Alternating game/debrief session in each room (office within the bedroom, living room, bedroom) and evaluation questions.
Topics addressed and educational content	**Game** Knowledge, identification and management of emotions. **Debriefing session** - Tips and resources to identify and manage emotions. - Exchanges on the emotions felt during the exam periods.	**Game** Symptoms of depression through emotions: - Stress and anxiety: general emotion, fear. - Anhedonia: sadness. - Self-devaluation: disgust. Other topics related to mental health which are addressed: - Names of some mental health illnesses. - Stigmatisation of mental health and of mentally ill. - Resources **Debriefing session** **Room 1 - Office within the bedroom** - Stress and anxiety: definitions and differences. Association to depression. **Room 2 - Living room** - Relation mental health and anhedonia. Association to depression.

		Room 3 – Bedroom - Relation mental health and self-devaluation. Association to depression. **Debriefing/end of the game:** - Emotions not previously addressed during the game. - Relation previously seen symptoms and depression. - Importance of having good mental health. - Resources in case of a mental health problem.
Character(s)	Tony, confined student.	Tony, confined student. Tony's roommate, Hana. A researcher who appears on the screen of the players to give indications and clues if desired.
Team competition	Accumulation of points according to the speed with which the player solves puzzles.	Accumulation of points according to several factors: speed in solving a puzzle, number of clicks used, time spent in each room and in the entire game, correct answers to evaluation questions. Teams can also lose points if they choose to access clues to solve puzzles or if they answer assessment questions incorrectly.
Scenario	Tony is a confined student during the first lockdown in his flatshare. We follow throughout the game the emotions he felt throughout this period. Players must solve puzzles to access emotion cards.	Same scenario than in the version one. The presence of the new character changes the transition from one room to the other. Players must solve puzzles to access emotion cards.
Scenography	The graphics of the game are similar to an apartment of a young worker and not a student. The vocabulary used by Tony is not adapted to the target audience.	Student flatshare, instead of having an office and a separate two-piece bedroom, the office is in one side of Tony's room. Tony's voice and vocabulary have also been adapted for the target audience.

In particular, substantial modifications concerned the introduction of mental health-related information in the game. Students had confirmed that the first version of the game was exclusively oriented towards emotions and their management. There were no specific elements on mental health described as either mental diseases or psychological wellbeing. In "EscapeCovid", the terms "depression", "stress" and "anxiety" were used in the speech by the main character. In particular, the symptoms and consequences of these problems were presented in the storytelling. Depression, stress and anxiety were selected since they are the most frequent psychological troubles in the young[29]. Players were supposed to learn more about mental health problems (mental health literacy), to destigmatize them (positive beliefs about mental health) and to be able to tackle them (positive coping strategies). Puzzles and enigmas were used to teach these concepts with debriefing sessions to reinforce the learning process. Given their expertise on the field, healthcare students helped with the writing of the scenarios, from the enigmas to the summary sheets. Using a co-creation approach, produced contents were revised by all stakeholders who were expert in public health and psychology.

The graphics were also modified as showed in Figure 3.

<Insert Figure 3 about here>

Playing the "EscapeCovid" game

The Escape Game scenario takes place in Tony's apartment that he shares with another student, Hana, during the Covid-19 first lockdown. Tony is a University student and is taking courses remotely. Throughout the game, we follow him during a typical day in lockdown. There are 3 rooms in Tony's apartment: office (within the bedroom), living room and bedroom. To move from one room to another, we must solve all the puzzles we find by clicking on the objects which are spread out in the room. When click on an object, there is an enigma to solve which is linked to other enigmas. We can move to another room only if we have solved all the enigmas by uncovering clues or cracking codes on the sofa, among books, on the floor, etc. There is a limited number of clicks per participant.

At the end of each room scenario, cards appear with mental health-related messages linked to the puzzles. For instance, in the living room we see Hana sleeping on the sofa in the dark with some books around her with titles containing the words "depression" or "pain", etc. By solving clues and clicking, we have to switch the light on and tidy up the room to make her recover strength. The cards summarize the messages transmitted through the puzzles in the room. In this case, they explain the symptoms of depression and give tips for coping with distress.

"EscapeCovid" is played in groups of 4 to 6 gamers who help each other and exchange through their computer cameras and headphones. This encourages team spirit for mutual aid, which can be the reflection of real life in case of mental suffering. All along the game, the group of players is supported by a game guide who explains the rules and answers any questions. The same guide concludes the game session with a final debrief where all participants talk about their experience. This final stage is essential for understanding and retaining the mental health-related take-away

DISCUSSION

Main findings of this study showed that students enjoyed playing Escape Games. This reflects general young people's appreciation for these tools and, more broadly, serious games using an entertaining approach for experiential learning [30]. While playing, students were attracted by the scenario and delivered messages, feeling motivated to follow the story. Testers considered Escape Games as a tool helping learn new health-related topics, in line with previous research on healthcare

students playing a game on diabetes[21]. Playing in groups was also a strategy to make connections and combat isolation, particularly experienced during Covid-19.

According to testers, the new version had to be simpler and to exploit this pedagogical potential going beyond the fun of the game. For this, “EscapeCovid” presented supplementary contents on mental health, with more specific details on pathologies and advice for preventing or treating them.

Nonetheless, the first version of the game was considered as not adapted to a young audience. The character of Tony was not representative of students and his apartment did not reflect the environment of young adults. A meta-analysis on the gamification of learning confirms that the use of personified narrative components is particularly effective in promote behavioral learning[31]. In line with this, the new version of the game was meant to make players identify with the protagonist, with tailored language and scenario.

Overall, the co-creation approach was very informative. In particular, the questionnaire and the interviews supported openness for students to express their opinions and give inputs for the new game. In the second step, stakeholders felt free to be creative and innovate while following students’ guidelines. The fact of concretely testing the first version of the game was an advantage for providing relevant comments. Students’ contribution to the design process nurtured new ideas following a collective creativity approach[32]. Participants were motivated to co-create the game which was finally driven by their values. On the other hand, basing the co-construction process on an already existing pilot version facilitated the development of the final game since student testers did not have to design the game from scratch.

Strengths of this study include the use of multiple strategies for the co-creation of the game, from questionnaires to brainwriting through the two steps “testing” and “optimizing”. This approach can serve as a backing for future work on creating gamified interventions on health-related topics addressed to students. The fact that two different teams (one from University and the other from a start-up) collaborated to develop the game was also a plus: researcher scientific point of view was complementary to the business goal of the start-up with the common will of creating an evidence-based marketable product.

Study limitations include the fact that the number of testers was small. However, in co-creation

projects recruiting a limited sample is often necessary since exchanges are easier. Another limitation is that the students participating in the study were rewarded with a gift card, which could have significantly influenced the answers through a desirability bias. This was even more accentuated for interviewees that received two gift cards. Finally, the gender balance among the participants was skewed with more female students, which may have influenced the results of the test.

Conclusions

Our results suggest that co-creation contributes to improve the acceptability of a health promotion and disease prevention intervention and that an end-user-centered approach can facilitate the intervention tailoring. When conceiving a health-related Escape Game, we recommend to use the co-creation approach to increase players' appreciation and interest in the intervention, thus influencing eventually their learning process.

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Authorship confirmation/contribution statement

DL: Conceptualization, Investigation, Writing-Reviewing.
CV: Data curation, Writing- Original draft preparation.
HH: Data curation, Writing.
CT: Data curation, Writing.
IM: Conceptualization, Methodology, Investigation, Writing-Reviewing and Editing, Supervision.

Author Disclosure Statement

DL and HH are employees of the start-up Tricky developing the game described in this paper. Results of the study are totally transparent.

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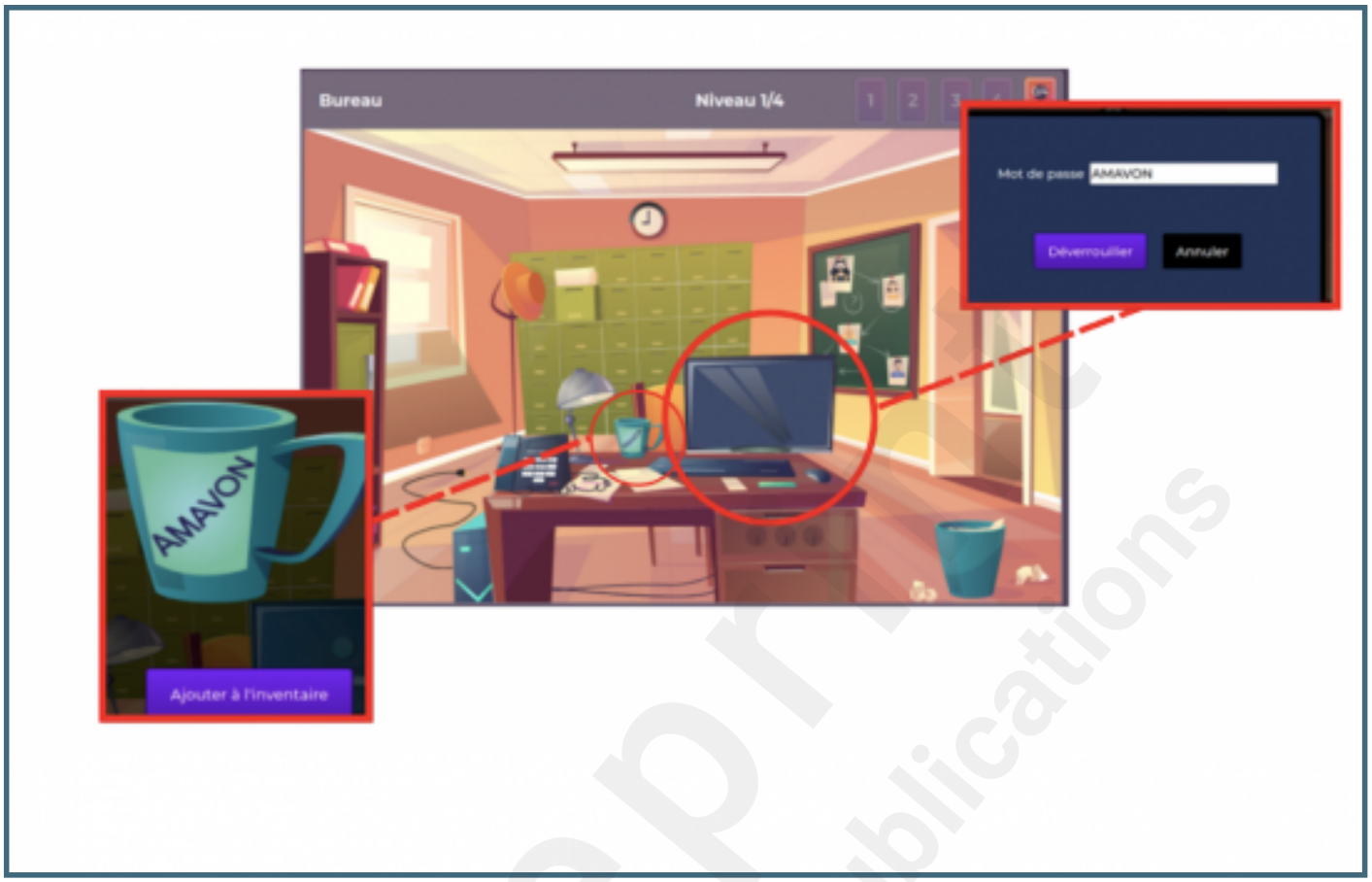
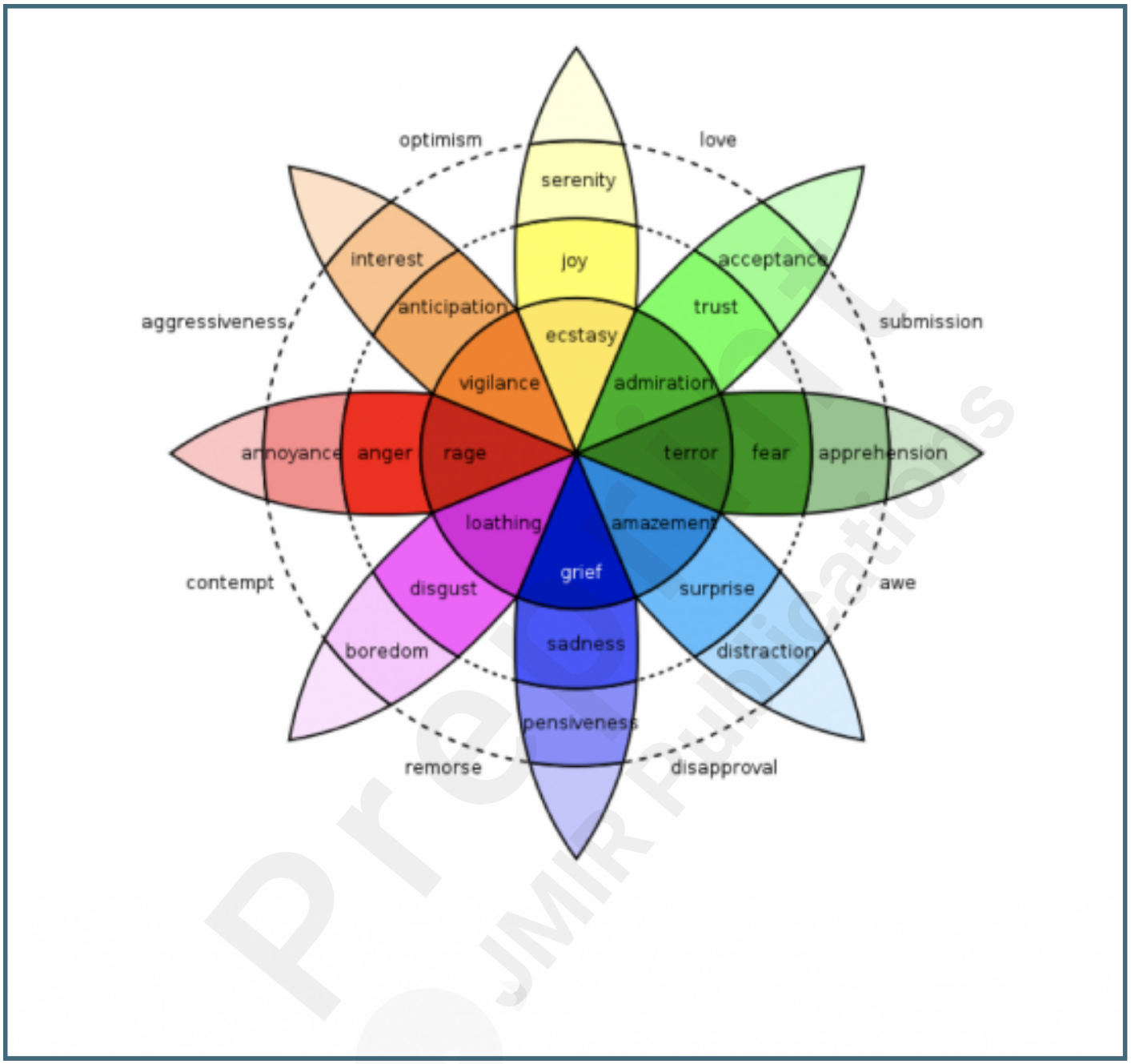
Supplementary Files

Figures

Tony's office in the Escape Game "Manage your Emotions".



Plutchik's wheel of emotions.



Evolution of the graphics of the first room of "Manage your Emotions" vs. EscapeCovid.

TOC/Feature image for homepages

Tricky Escape Rooms.